

A New Species of *Cnemaspis* (Sauria: Gekkonidae) from Southern Thailand

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Abstract: A new species of *Cnemaspis* is described from Phuket Island, southern Thailand. The new species can be distinguished from congeners from Southeast Asia by the following combination of characters: SVL to 29.1 mm, two semi-circular supranasals separated by a single scale; three postnasals bordering nasal; four scale rows separate orbit from supralabials; posteriorly, each postmental bounded by three smooth, rounded, and juxtaposed scales; scattered spinose paravertebral rows of tubercles on dorsum; gular and pectoral scales uncarinate; abdominal scales not elongated, smooth; tail segmented, with enlarged flattened scales forming whorls, a single pair of spinose postcloacal spurs present; median subcaudals not enlarged, smooth; supralabials (to midorbit position) 6–7; infralabials 6–7; lamellae under toe IV 16–17; midventrals 26–32; and adult males lack preanal and femoral pores.

Key words: *Cnemaspis phuketensis*; new species; systematics; Reptilia; Sauria; Phuket Island; Thailand

INTRODUCTION

Four species of the gekkonid lizard genus *Cnemaspis* Strauch: *affinis* (Stoliczka, 1870) *chanthaburiensis* Bauer and Das, 1998, *kumpoli* Taylor, 1963, and *siamensis* (Smith, 1925), are known from within the political limits of Thailand (Chan-Ard et al., 1999). Two other species have been recorded from the country: Taylor (1963), in his review of the Thai herpetofauna, listed *C. kandiana* (Kelaart,

1852) (type locality: “Kandian hills, Ceylon” = hills of Kandy [or Mahanuwara], Central Province, Sri Lanka) and *C. mysoriensis* (Jerdon, 1853) (type locality: “Bangalore” [in Karnataka State, southwestern India]), from Thailand. The first species has also been recorded from mainland India (Annandale, 1909; Abdulali, 1955; Thakur, 1998; Thomas and Easa, 1997), the Andaman and Nicobar Islands (Smith, 1935), Thailand (Taylor, 1963; Cox et al., 1998), Sumatra (De Rooij, 1915; Rösler, 1981) and the Mentawai Archipelago (Boulenger, 1885, 1890). Bauer (2002) reported that the Western Ghats populations belong to a species distinct from *C. kandiana*, and Das (in press and unpubl.) will show that the

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Mentawai and Andaman and Nicobar species are not conspecific with the Sri Lankan species. Dring (1979), in his key to the genus for Southeast Asia included Taylor's *mysorientis* in the synonymy of *kendallii*.

Cnemaspis is a speciose genus of gekkonids, and a large number of species have been described in recent years from southern and southeastern Asia (compare Kluge, 1993, 2001; Bauer, 2003; to Wermuth, 1966). We report here a new species of the genus from Phuket Island, southern Thailand. This species has been earlier reported as *C. kandiana* by Cox et al. (1998) and *Cnemaspis* sp. in Grossmann and Tillack (2000).

MATERIALS AND METHODS

Specimens were hand-collected. The holotype was photographed in life and fixed in formalin, before storage in ethanol. The following measurements were taken ca. 18 months after collection with a Mitutoyo™ dial caliper (to the nearest 0.1 mm): snout-vent length (SVL; from tip of snout to vent); tail length (TL; from vent to tip of unregenerated tail); tail width (TW; measured at base of tail); head length (HL; distance between posterior edge of last supralabial and snout-tip); head width (HW; measured at angle of jaws); head depth (HD; maximum height of head, from occiput to throat); ear length (EL; greater ear length); forearm length (FA; distance between the palm and elbow); eye diameter (ED; greatest diameter of orbit); eye to nostril distance (E-N; distance between anteriormost point of eyes and nostrils); eye to snout distance (E-S; distance between anteriormost point of eyes and tip of snout); eye to ear distance (E-E; distance from anterior edge of ear opening to posterior corner of eyes); internarial distance (IN; distance between nares); and interorbital distance (IO; shortest distance between orbits). Scale counts and external observations of morphology were made using an Olympus SZX9 dissecting microscope. Notes on colour in life are from colour swatches of F. B. Smith (1975; 1981).

Comparative material examined is shown in the Appendix. Additional sources of information on character states include: Smith (1935), Nicholls (1949), Dring (1979), Das (1993), Manthey and Grossmann (1997), Das and Bauer (1998), Bauer and Das (1998), and Das and Grismer (2003). Catalogue numbers of specimens deposited in the Raffles Museum of Biodiversity Research, National University of Singapore, Singapore, are preceded by ZRC instead of USDZ as formerly proposed by Leviton et al. (1985). The other institutional abbreviations follow Leviton et al. (1985).

Cnemaspis phuketensis sp. nov.

Fig. 1

Holotype

ZRC 2.5212, Kathu Falls (07°55'N; 98°20'E), Changwat Phuket, Thailand, adult male, T.-M. Leong, collector, 1 September 2002.

Paratypes

ZRC 2.5214–18, paratopotypes, other data as for holotype, except collected 2 September 2002; ZRC 2.5233, Manik Falls, Changwat Phuket, Thailand, Tzi-Ming Leong, collector, 4 September 2002.

Diagnosis

A small species of *Cnemaspis* (SVL to 29.1 mm), distinguishable from conspecific species in showing the following combination of characters: two semi-circular supranasals separated by a single scale; three postnasals bordering nasal; four scale rows separate orbit from supralabials; posteriorly, each postmental bounded by three smooth, rounded and juxtaposed scales; scattered spinose paravertebral rows of tubercles on dorsum; gular and pectoral scales uncarinate; abdominal scales not elongated, smooth; tail segmented, with enlarged flattened scales forming whorls, a single pair of spinose postcloacal spurs present; median subcaudals not enlarged, smooth; supralabials (to midorbit position) 6–7; infralabials 6–7; lamellae under toe IV 16–17; midventrals 26–32; and adult males lack preanal and femoral pores.



FIG. 1. The holotype of *Cnemaspis phuketensis* sp. nov. (ZRC 2.5212) in life.

Description of holotype

A small species of *Cnemaspis* (snout-vent length 29.0 mm); snout elongate, large (HL/SVL ratio 0.18), narrow (HW/SVL ratio 0.16), depressed (HD/HL ratio 0.66), distinct from neck; lores sloping and interorbital region flattened; snout long (E-S/HW ratio 0.87), longer than eye diameter (ED/E-S ratio 0.43); scales on snout and forehead warty, under magnification revealed as tubercles that are raised towards posterior of each scale; scales on snout larger than those on occipital region; eye large (ED/HL ratio 0.32); 'extra-brilliar fringes' (of Underwood, 1954) indistinct; pupil round; elongated supraciliaries on top half of orbit; ear-opening deep, slit-like, its greatest diameter vertically, fairly narrow (EL/E-S ratio 0.13); eye to ear distance greater than diameter of eyes (E-E/ED ratio 1.59); no ridge of tubercles along mandible or from posterior of orbit to postero-venter of tympanum, or from antero-dorsum of tympanum to nape; rostral completely divided by a simple rostral groove which meets anterior of snout; rostral less than half as deep as wide (rostral width=

1.3 mm/rostral depth=0.5 mm; width/depth ratio 2.6); contacted posteriorly by two nostrils and two semi-circular supranasals that are separated by a single scale; ventro-posteriorly, rostral is in contact with supralabial I; nostrils oval, situated within nasals, and oriented laterally; nasals reduced, in broad contact with supralabial I; anterior nasal larger than posterior nasal; three postnasals bound nasal; four scale rows separate orbit from supralabials; mentals subtriangular, deeper than wide, paired postmentals that are semicircular, smaller than mental and separated by a single scale; posteriorly, each postmental is bounded by three smooth, rounded and juxtaposed scales; tongue narrowly elongate, with a weak median cleft.

Body slender, elongate (A-G/SVL ratio 0.51); scale size does not decrease dorsally after thorax; ventrally, scales do not decrease in size from chin region to gular, pectoral and abdominal regions; scales on dorsum at mid-body unicarinate, smaller than those of ventrum at same level; scales along vertebral region not differentiable from adjacent scales; scattered spinose tubercles on paravertebral

region not arranged in rows; pectoral and abdominal scales not elongate, smooth; spinous processes on lateral surface of body; scales on manus and pes smooth, rounded; scales on inner surface of forearm, distal aspect of upper arm, dorsal surface of thighs, tibia; upper arm and forearm uncarinate.

Forelimbs moderately long, slender; hindlimbs relatively short; tibia short (TBL/SVL ratio 0.18); no shield-like subtibial scales; digits elongate, all bearing claws that are slightly recurved; subdigital scansors entire, unnotched; no fragmented basal lamellae, six enlarged scansors at base of digits, which are more than twice width of other scansors; lamellae under digit IV of pes 16 (including the enlarged basal ones); interdigital webbing absent; relative length of digits (finger): $3 > 2 > 4 > 5 > 1$; (toe): $3 > 4 > 5 > 2 > 1$.

Original tail long, tip missing, preserved portion of tail longer than snout-vent length (TL/SVL ratio 1.21); tail tip blunt, tail base swollen, segmented, with enlarged flattened scales with a median keel forming whorls, a single pair of spinose postcloacal spur present; tail with a distinct pair of furrow laterally; median subcaudals not enlarged, smooth; scales on postanal region and at proximal part of tail base and on rest of subcaudals smooth; hemipeneal swelling at tail base, preanal depression present.

Scutellation.

See Table 1.

Colouration (in life)

Dorsum olive (# 30), with sinuous, dark grayish brown (# 20) markings on nape, axilla, torso and inguinal regions, labials dark-barred; spinose tubercles on flanks chamois (# 123D); limbs and tail dark-banded; a dark grayish brown (# 20) canthal stripe, commencing from snout, traversing the orbit region and extending to axilla; throat and undersurface of tail with fine hair brown (# 119A) mottlings; rest of venter unpatterned cream; iris buff yellow (# 53); pupil black.

Measurements (in mm).

See Table 2.

Sexual dimorphism

ZRC 2.5212, 2.5214–17 are adult males (presence of hemipeneal swelling at tail base, with preanal depression; ZRC 2.5218 and 2.5233 are adult females (lack of hemipeneal swelling or preanal depression). Preanal and femoral pores are absent in males. Females lack obvious endolymphatic sacs that are visible externally in many adult female geckos.

Etymology

Latin implying an inhabitant of Phuket Island, in southern Thailand.

TABLE 1. Squamation data of the holotype (ZRC 2.5212) and paratypes of *Cnemaspis phuketensis* sp. nov. See text for details. Abbreviations: + = present; – = absent; M = male; F = female; SL = supralabial; IL = infralabial; IO = interorbital; T4 = lamellae under toe IV of pes; MV = midventral; PA = preanal depression

Character	Specimen						
	ZRC 2.5212	ZRC 2.5214	ZRC 2.5215	ZRC 2.5216	ZRC 2.5217	ZRC 2.5218	ZRC 2.5233
SL (MO)	6	6	7	7	7	6	7
IL	6	6	7	6	7	7	7
IO	9	7	7	7	8	7	7
T4	16	16	17	16	17	17	17
MV	30	28	26	30	32	32	32
Sex	M	M	M	M	M	F	F
PA	+	+	+	+	+	–	–

TABLE 2. Measurements (in mm) of the holotype (ZRC 2.5212) and paratypes of *Cnemaspis phuketensis* sp. nov. See text for details. Abbreviations: O=original tail; R=regenerated tail; SVL=snout-vent length; TL=tail length; FA=forearm length; TBL=tibia length; A-G=axilla to groin distance; HL=head length; HW=head width; HD=head depth; ED=eye diameter; E-E=eye to ear distance; E-S=eye to snout distance; E-N=eye to nostril distance; IO=interorbital distance; EL=ear length; and IN=internarial distance.

Character	Specimen						
	ZRC 2.5212	ZRC 2.5214	ZRC 2.5215	ZRC 2.5216	ZRC 2.5217	ZRC 2.5218	ZRC 2.5233
SVL	29.0	27.1	27.7	26.1	28.4	29.1	26.8
TL	35.0	28.2	21.1	34.2	21.3	33.6	32.5
FA	5.5	5.0	4.8	4.1	4.3	4.6	4.5
TBL	5.2	5.0	5.5	5.5	5.4	5.5	5.3
A-G	14.9	14.1	12.2	12.9	13.4	12.8	12.1
HL	5.3	4.7	5.3	5.0	5.1	5.7	4.8
HW	4.6	4.6	5.0	4.3	4.7	5.3	4.5
HD	3.5	3.1	4.1	3.0	3.2	3.6	3.2
ED	1.7	1.5	1.8	1.5	1.7	1.5	1.5
E-E	2.7	2.5	2.2	2.2	2.4	2.5	1.9
E-S	4.0	3.2	3.5	3.0	3.7	3.5	3.3
E-N	2.8	2.3	2.8	2.7	2.6	2.8	2.5
IO	3.0	2.4	2.7	2.2	2.7	2.8	2.2
EL	0.5	0.3	0.4	0.5	0.5	0.5	0.5
IN	0.9	1.1	1.1	1.0	1.1	1.1	1.0
Tail	O	O	R	O	R	O	O

Natural history notes

The holotype was taken from a leaf of an herb, 5 cm above substrate; the paratypes from either earth banks beside a small stream or from tree trunks at chest level, during the day. Leong et al. (2003) recorded the following additional saurian species as sympatric: *Draco taenioptera* Günther, 1861 (at Kathu Falls), and *Cyrtodactylus oldhami* (Theobald, 1876) (at both Kathu and Manik Falls).

Comparisons

The new species from Phuket, Thailand, is compared with congeners from Thailand. Only opposing suites of characters are listed. *Cnemaspis affinis* (Stoliczka, 1870), distribution: southern Thailand and Peninsular Malaysia: SVL to 48.0 mm; a dark marking at axilla; no enlarged tubercles on tail; and dorsal surface with five transverse yellow bands; *C. chanthaburiensis* Bauer & Das, 1998, distribution:

Chanthaburi Province, Thailand: SVL to 41.0 mm; a ridge of tubercles border anterior margin of ears and another from ear to nape; a series of white paravertebral markings between nape and tail; and belly mottled light brown; *C. kumpoli* (Taylor, 1963), distribution: Trang in southern Thailand: SVL to 52.0 mm; supralabials 11; posterior supralabials with longitudinal keels; and three postcloacal spurs; and *C. siamensis* (Smith, 1925), distribution, Thailand and northern Peninsular Malaysia: SVL to 39.7 mm; forehead with keeled scales; supralabials 9–11; infralabials 8–10; paravertebral tubercles in 12 or 14 rows; and ventrals and subcaudals tricarinate.

The new Thai species is next compared with other south-east Asia congeners. *C. argus* Dring, 1979, distribution: Gunung Lawit in northern Terengganu, Malay Peninsula: SVL to 65.3 mm; fourth and fifth fingers subequal; supralabial VIII in midorbital position; and

yellow radiating lines from the orbits; *C. boulengerii* Strauch, 1887, distribution: Con Son Island, Vietnam: SVL to 66.0 mm; supralabials 8–10; infralabials 7–8; a series of 6–7 shield-like subtibial scales; subcaudal scales almost as wide as tail, and large black nuchal and shoulder spots; *C. dringi* Das & Bauer, 1998, distribution: Kapit District, central Sarawak, East Malaysia (Borneo): SVL to 45.5 mm; five postnasals; postcloacal spurs absent; toe IV lamellae 20; flanks with distinct white patches; and ventrals heavily pigmented; *C. flavolineata* (Nicholls, 1949), distribution, the northern Malay Peninsula: SVL to 46.7 mm; yellow line along back; paired, elongate postmentals; and lamellae under toe IV 28; *C. gordongekko* Das, 1993, distribution, Lombok Island, Lesser Sundas, Indonesia: SVL to 73.0 mm; lamellae under toe IV 22–23; supralabials at midorbital position 9; infralabials 10; interorbitals 20, and throat scales smooth; *C. kendallii* (Gray, 1845), distribution: Borneo, the Riau Archipelago and peninsular Malaysia: SVL to 58.0 mm; tubercles on dorsum keeled; postnasals six; postmentals bounded by 4–5 scales posteriorly; two rows of tubercles run posteriorly from orbit towards tympanum; and median subcaudal scales raised; *C. nigridia* (Smith, 1925), distribution, Bau and Gunung Gading, western Sarawak, East Malaysia (Borneo) as well as Natuna Island: SVL to 69.8 mm; supranasals in wide contact; postmentals bounded by four scales posteriorly; postnasals five; two rows of tubercles run posteriorly from orbit towards tympanum; and tail without dark bands; and *C. timoriensis* (Duméril & Bibron, 1836), distribution, Timor, without specific information, and may be either West Timor, Republic of Indonesia, or the newly-independent nation of East Timor: SVL to 35 mm; dorsum with no enlarged tubercles; supralabials five; lamellae under toe IV 12; and dorsal surface reddish-brown, with a series of brown paravertebral spots.

Two further species of the genus have been recently described from the Seribuat Archipelago, off the east coast of Peninsular Malaysia (Das and Grismer, 2003). One of these,

Cnemaspis limi from Pulau Tioman, Pahang State, can be differentiated from the new Thai species in being significantly larger-SVL to 88.2 mm; supranasals in contact; supralabials 11–14; and scales on forearm smooth. The second Seribuat species, *C. baueri*, is from Pulau Aur, Johor State, and differs from the new species in being much larger, SVL to 64.9 mm; fourth toe longer than fifth; lamellae under toe IV 26–27; supralabials 11–13; scales on forearm smooth; and caudal bands absent.

Affinities of the new Thai *Cnemaspis* remain unknown, for lack of a phylogenetic hypotheses for the genus. Several distinct and apparently unrelated species, once allocated to *C. kandiana*, are now known, the association with this Sri Lankan endemic is for sharing spinose flanks, comprising tuberculate scales, keeled gular scales, and the presence of preanal and femoral scales.

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APPENDIX

Comparative material examined

Cnemaspis affinis (Stoliczka, 1870): ZSI 5964 (holotype), ZRC 2.1098, “Penang” (=Pulau Pinang, West Malaysia); ZMA 11987, Pinang, West Malaysia; ZRC 2.4858, Moon Gate, Pulau Pinang, West Malaysia; Maxwell’s Hill, Perak, West Malaysia (ZRC 2.1100; 2.1099).

Cnemaspis boulengerii Strauch, 1887: CAS 73745 (paratype of *Gonatodes glaucus* Smith, 1920), MCZ 39014–23, “Pulo Condore” (=Con Dao), Vietnam.

Cnemaspis chanthaburiensis Bauer & Das, 1998: FMNH 215979 (holotype), “Khao Soi Daouw (Dao) Wildlife Sanctuary, Pongnomron (Pong Nam Ron), Chantaburi (Chanthaburi) Province, Thailand (approximately 13°00'N, 102°05'E)”; BMNH 1917.5.14.4 (paratype), “Chantaburi (Chanthaburi Province), Siam (Thailand)”; FMNH 191479 (paratype), “Khao Soi Dao Tai, Pong Nam Ron, Chantaburi (Chanthaburi) Province, Thailand (approximately 13°00'N, 102°05'E), 850 m.”; FMNH 215978 (paratype), “Khao Khiew (Khieo) Wildlife Sanctuary, Chon Buri Province, Thailand (approximately 13°14'N, 101°08'E)”; FMNH 215980 (paratype), “Amphoe Muang, Suan

Kaset, Chantaburi (Chanthaburi) Province, Thailand (approximately 123°6'N, 102°09'E)”.

Cnemaspis gordongekkoi Das, 1993: ZRC 2.3380 and ZRC 2.3381 (holotype and paratype), “..vicinity of Sendanggila Falls, circa 0.5 km south of Senaru village, Lombok, Nusa Tenggara District, Republic of Indonesia (8°45'S, 116°30'E)”.

Cnemaspis dringi Das & Bauer, 1998: FMNH 148588 (holotype), “Labang Camp (03°20'N; 113°29'E), Bintulu District, Fourth Division, Sarawak, East Malaysia, Borneo”; FMNH 221478 (paratype), “Sungai Segaham (02°44'N; 113°53'E), Belaga District, Seventh Division, Sarawak, East Malaysia”.

Cnemaspis kandiana (Kelaart, 1852): BMNH 60.3.17.1066, 80.2.2.119, 53.4.1.1 (three syntypes), “Kandian hills, Ceylon” (=hills of Kandy [or Mahanuwara], 07°15'N; 80°40'E, Central Province, Sri Lanka); MCZ 4138, 26719, “Ceylon” (=Sri Lanka); ZSI 5971 (holotype of *Gymnodactylus Humei* Theobald, 1876), “Kandy” (see comments above); MSNG 8764 (four specimens), “Ceylon” (=Sri Lanka).

Cnemaspis kendallii (Gray, 1845): BMNH XXII.92a (lectotype, designated by Dring, 1979), “Borneo”; FMNH 223201, MCZ 157158–59. Bako National Park, Sarawak, East Malaysia (Borneo); FMNH 223201; MCZ 157158–59. Bidi, Sarawak, East Malaysia (Borneo); FMNH 184424. Bukit Lanjan, Selangor, West Malaysia; BMNH 1902.12.12. 12. Bidi, Sarawak, East Malaysia (Borneo); Bau, Sarawak, East Malaysia (Borneo); BMNH 1911.1.20.7–9. Bau, Sarawak, East Malaysia (Borneo); BPBM 7494, Alag Sungei Ayer, Pulau Tioman, Pahang, West Malaysia; ZRC 2.1101. Jerantut, Pahang, West Malaysia; ZRC 2.1102, Gunung Rokan, Pulau Tioman, Pahang, West Malaysia; ZRC 2.1103. Sedagong, Pulau Tioman, Pahang, West Malaysia; ZRC 2.1109–10. Pulau Siantan, Anamba, Riao Archipelago, Indonesia; ZRC 2.1112–13. Sungei Ulu, Great Natuna, Riao Archipelago, Indonesia; ZRC 2.3014. Bukit Timah, Singapore; ZRC 2.3015. Gunung Ladang, Melaka, West Malaysia; USNM 26573. Pulau Bunoa, Tambelan Islands, Indonesia; USNM 26555. St.

Barbe Island, at present Pulau Pedjantan, Indonesia; USNM 26547–49. Bunguran, Natunas, Riao Archipelago, Indonesia; USNM 28145. Pulau Lingung, Natuna, Riao Archipelago, Indonesia; USNM 28149. Sirhassen, Natuna, Riao Archipelago, Indonesia; also UF 78463 and ZSI 14767 and 19637, from “Borneo”.

Cnemaspis nigridia (Smith, 1925): BMNH 1946.8.22.90 (formerly BMNH 1925.9.1.8; holotype), MCZ 39024 and ZRC 2.1114–115, “Mt. Gadin” (=Gunung Gading, 01°44'N; 109°50'E, Sarawak, East Malaysia; Borneo); MCZ 15250, Lundu, Sarawak, East Malaysia; BMNH 1925.9.1.9–10, Gunung Pueh, Sarawak, East Malaysia.

Cnemaspis siamensis (Smith, 1925): MCZ 39025, Maprit, Patiyu, peninsular Thailand;

MCZ 39694, Klong Bang Lai, peninsular Thailand.

Cnemaspis limi Das & Grismer, 2003: ZRC 2.5289 (holotype); ZRC 2.5290 (paratype). “Gua Tengku Air, Gunung Kajang (02°50'N; 104°09'E), Pulau Tioman, Pahang, West Malaysia, altitude 980 m”; ZRC 2.3504–06 (three paratypes). Tekek-Juara trail (02°52'N; 104°12'E), Pulau Tioman, Pahang, West Malaysia.

Cnemaspis baueri Das & Grismer, 2003: ZRC 2.5291 (holotype); ZRC 2.5292–99 (eight paratypes). Kampung Berhala (02°27'N; 104°30'E), Pulau Aur, Johor, West Malaysia.

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